Exercise - I (Conceptual Questions) Build Up Your Understanding

GRAHAM'S LAW OF DIFFUSION

1. Which pair of the gaseous species diffuse through a small jet with the same rate of diffusion at same P and T :
(1) NO, CO (2) NO, CO_2
(3) NH_3, PH_3 (4) NO, C_2H_6

2. The rate of diffusion of methane at a given temperature is twice that of a gas X. The molecular weight of X is :
(1) 64 (2) 32 (3) 4.0 (4) 8.0

3. The increasing order of effusion among the gases, H_2, O_2, NH_3 and CO_2 is –
(1) H_2, CO_2, NH_3, O_2
(2) H_2, NH_3, O_2, CO_2
(3) H_2, O_2, NH_3, CO_2
(4) CO_2, O_2, NH_3, H_2

4. Gas A having molecular weight 4 diffuses thrice as fast as the gas B at a given T. The molecular weight of gas B is :
(1) 36 (2) 12 (3) 18 (4) 24

5. Four rubber tubes are respectively filled with H_2, O_2, N_2 and CO_2. The tube which will be deflated first is :
(1) H_2 filled tube (2) O_2 filled tube
(3) N_2 filled tube (4) CO_2 filled tube

6. A balloon filled with methane CH_4 is pricked with a sharp point and quickly plunged into a tank of hydrogen at the same pressure. After some time the balloon will have :
(1) Enlarged
(2) Collapsed
(3) Remain unchanged in size
(4) Ethylene (C_2H_4) inside it

7. Rate of diffusion of hydrogen is :
(1) Half of He
(2) 1.4 times of He
(3) Double than He
(4) Four times of He

8. A football bladder contains equimolar proportions of H_2 and O_2. The composition by mass of the mixture effusing out of punctured football is in the ratio (H_2 : O_2)
(1) 1 : 4 (2) $2\sqrt{2}$: 1
(3) 1 : $2\sqrt{2}$ (4) 4 : 1

9. If the vapour densities of methane & oxygen are in the ratio 1 : 2, the ratio of rate of diffusion of O_2 & CH_4 is respectively
(1) 1 : 2 (2) 1 : 1.414
(3) 2 : 1 (4) 1.414 : 1

10. A gas X diffuses three times faster than another gas Y. The ratio of their densities i.e., D_x : D_y is
(1) 1/3 (2) 1/9
(3) 1/6 (4)1/12

11. The relative rate of diffusion of a gas (Mol wt. = 98) as compared to hydrogen will be :
(1) 1/7 (2) 1/5
(3) 1/4 (4) 1

12. The relative rate of diffusion of a gas (molecular weight = 128) as compared to oxygen is
(1) 2 times (2) 1/4 times
(3) 1/8 times (4) 1/2 times

13. Since the atomic weights of carbon, nitrogen and oxygen are 12, 14 and 16 respectively, among the following pairs of gases, the pair that will diffuse at the same rate is :
(1) Carbon dioxide and nitrous oxide
(2) Carbon dioxide and nitrogen dioxide
(3) Carbon dioxide and carbon monoxide
(4) Carbon dioxide and nitric oxide

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14. A bottle of dry ammonia and a bottle of dry hydrogen chloride connected through a long tube are opened simultaneously at both ends, the white ammonium chloride ring first formed will be :
(1) At the centre of the tube
(2) Near the hydrogen chloride bottle
(3) Near the ammonia bottle
(4) Throughout the length of the tube

15. 50 ml of a gas A diffuses through a membrane in the same time as for the diffusion of 40 ml of a gas B under identical pressure and temperature conditions. If the Molecular weight of A = 64, that of B would be :
(1) 100 (2) 250 (3) 200 (4) 80

16. If rate of diffusion of A is 5 times that of B. What will be the ratio of density of A and B :
(1) 1/25 (2) 1/5 (3) 25 (4) 5

17. 50 ml of hydrogen diffuses through a small hole from vessel in 20 minutes time. Time taken for 40 ml of oxygen to diffuse out under similar conditions will be :
(1) 12 min. (2) 64 min
(3) 8 min (4) 32 min

18. The densities of two gases are in the ratio of 1 : 16. The ratio of their rates of diffusion is :
(1) 16 : 1 (2) 4 : 1
(3) 1 : 4 (4) 1 : 16

19. The rate of diffusion of a gas having molecular weight just double of nitrogen gas is 56 ml per sec the rate of diffusion of nitrogen gas will be:
(1) 79.19 ml/sec (2) 112 ml/sec
(3) 56 ml/sec (4) 90 ml/sec

20. Under identical conditions of temperature and pressure, the ratio of the rates of effusion of O_2 and CO_2 gases is given by :
(1) $\frac{\text{rate of effusion of oxygen}}{\text{rate of effusion of } CO_2} = 0.87$
(2) $\frac{\text{rate of effusion of oxygen}}{\text{rate of effusion of } CO_2} = 1.17$
(3) $\frac{\text{rate of effusion of oxygen}}{\text{rate of effusion of } CO_2} = 8.7$
(4) $\frac{\text{rate of effusion of oxygen}}{\text{rate of effusion of } CO_2} = 0.117$

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DEVIATION FROM IDEAL GAS BEHAVIOUR

21. When does a real gas show behaviour same as ideal gas:
(1) At low temperature and low pressure
(2) At high temperature and high pressure
(3) At low temperature and high pressure
(4) At high temperature and low pressure

22. In van der Waal's equation, the constant 'b' is a measure of :
(1) Intermolecular repulsions
(2) Intermolecular attraction
(3) Volume occupied by the molecules
(4) Intermolecular collisions per unit volume

23. Pressure of real gas is less than the pressure of ideal gas because :
(1) No. of collisions increases
(2) Definite shape of molecule
(3) K.E. of molecule increases
(4) Inter molecular forces

24. Which gas can be easily liquefied ?
given 'a' for $NH_3 = 4.17$, $CO_2 = 3.59$, $SO_2 = 6.71$, $Cl_2 = 6.49$
(1) NH_3 2) Cl_2
(3) SO_2 (4) CO_2

25. At relatively high pressure, van der waals' equation reduces to :
(1) PV = RT (2) $PV = RT + \frac{a}{V}$
(3) PV = RT + Pb (4) $PV = RT - \frac{a}{V^2}$

26. A real gas most closely approaches the behaviour of an ideal gas at:
(1) 15 atm and 200 K
(2) 1 atm and 273 K
(3) 0.5 atm and 500 K
(4) 15 atm and 500 K

27. The compressibility factor of an ideal gas is :
(1) 0 (2) 1 (3) 2 (4) 4

28. The compressibility of a gas is less than unity at STP therefore :
(1) $V_m > 22.4$ L (2) $V_m < 22.4$ L
(3) $V_m = 22.4$ L (4) $V_m = 44.8$ L

29. The values of van der Waal's constant 'a' for the gases O_2, N_2, NH_3 and CH_4 are 1.360, 1.390, 4.170 and 2.253 L^2 atm mol^{-2} respectively. The gas which can most easily be liquefied is:
(1) O_2 (2) N_2 (3) NH_3 (4) CH_4

30. Which of the following is not correct for real gases ?
(1) No force of attraction between the molecules of a gas.
(2) Volume of the molecules of a gas is negligible in comparison to the space occupied by the gas.
(3) Do not follow PV = nRT.
(4) Both (1) & (2)

31. The Boyle temperature or Boyle point is :
(1) The temperature at which ideal gas obeys real gas laws
(2) The temperature at which a real gas obeys ideal gas laws over an appreciable range of pressure
(3) It does not depend on nature of gas
(4) The temperature at which gases have no deviation

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	4	1	4	1	1	1	2	1	2	2	1	4	1	2	1
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	1	2	2	1	2	4	3	4	3	3	3	2	2	3	4
Question	31														
Answer	2														

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Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT Pre. 2011

1. Two gases A and B having the same volume diffuse through a porous partition in 20 and 10 seconds respectively. The molecular mass of A is 49u. Molecular mass of B will be :-
(1) 50.00 u (2) 12.25 u
(3) 6.50 u (4) 25.00 u

AIPMT Pre. - 2012

2. 50 mL each of gas A and of gas B takes 150 and 200 seconds respectively for effusing through a pin hole under the similar condition. If molecular mass of gas B is 36, the molecular mass of gas A will be:
(1) 20.25 (2) 64 (3) 96 (4) 128

AIPMT Main - 2012

3. A certain gas takes three times as long to effuse out as helium. Its molecular mass will be :
(1) 64 u (2) 9 u (3) 27 u (4) 36 u

NEET-UG 2013

4. Maximum deviation from ideal gas is expected from :
(1) $NH_3(g)$ (2) $H_2(g)$
(3) $N_2(g)$ (4) $CH_4(g)$

NEET(UG) 2018

5. Given van der Waal's constant for NH_3, H_2, O_2 and CO_2 are 4.17, 0.244, 1.36 and 3.59, L^2 atm mol^{-2} respectively which one of the following gases is most easily liquefied?
(1) NH_3 (2) H_2 (3) O_2 (4) CO_2

6. The correction factor 'a' to the ideal gas equation corresponds to
(1) Density of the gas molecules
(2) Volume of the gas molecules
(3) Electric field present between the gas molecules
(4) Forces of attraction between the gas molecules

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NEET(UG) 2019

7. A gas at 350 K and 15 bar has molar volume 20 percent smaller than that for an ideal gas under the same conditions. The **correct** option about the gas and its compressibility factor (Z) is :
(1) Z > 1 and attractive forces are dominant
(2) Z > 1 and repulsive forces are dominant
(3) Z < 1 and attractive forces are dominant
(4) Z < 1 and repulsive forces are dominant

NEET(UG) (Odisha) 2019

8. The volume occupied by 1.8 g of water vapour at 374 °C and 1 bar pressure will be :-
[Use R = 0.083 bar L $K^{-1}mol^{-1}$]
(1) 96.66 L (2) 55.87 L
(3) 3.10 L (4) 5.37 L

9. In water saturated air, the mole fraction of water vapour is 0.02. If the total pressure of the saturated air is 1.2 atm, the partial pressure of dry air is :-
(1) 1.18 atm (2) 1.76 atm
(3) 1.176 atm (4) 0.98 atm

NEET (UG) 2020

10. A mixture of N_2 and Ar gases in a cylinder contains 7g of N_2 and 8g of Ar. If the total pressure of the mixture of gases in the cylinder is 27 bar, the partial pressure of N_2 is:
[Use atomic masses (in g mol^{-1}) : N = 14, Ar = 40]
(1) 18 bar (2) 9 bar
(3) 12 bar (4) 15 bar

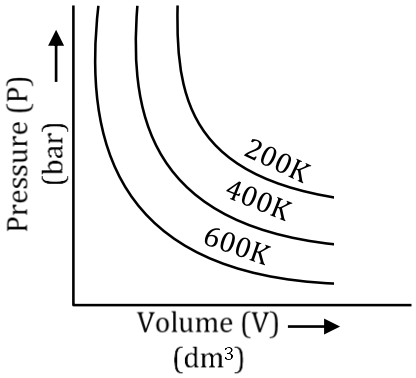
NEET (UG) 2020 (Covid-19)

11. The minimum pressure required to compress 600 dm^3 of a gas at 1 bar to 150 dm^3 at 40°C is
(1) 4.0 bar (2) 0.2 bar
(3) 1.0 bar (4) 2.5 bar

NEET (UG) 2021

12. Choose the correct option for graphical representation of Boyle's law, which shows a graph of pressure vs. volume of a gas at different temperatures:

(1)



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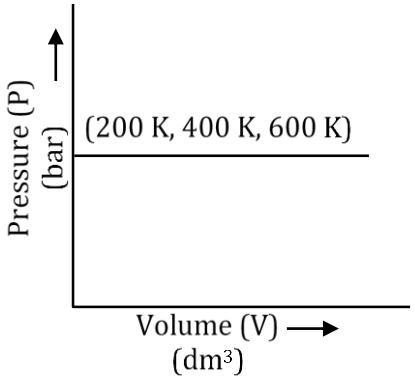

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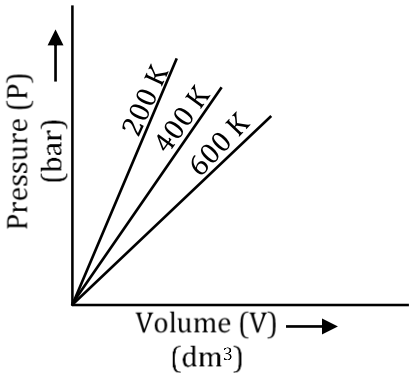

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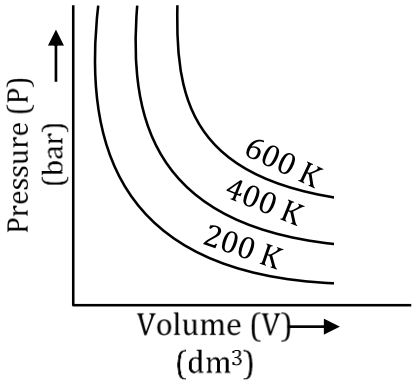

13. Choose the correct option for the total pressure (in atm.) in a mixture of 4 g O_2 and 2 g H_2 confined in a total volume of one litre at 0°C is:
[Given R = 0.082 L atm $mol^{-1}K^{-1}$, T=273K]
(1) 2.518 (2) 2.602
(3) 25.18 (4) 26.02

NEET (UG) 2022

14. A 10.0 L flask contains 64 g of oxygen at 27°C. (Assume O_2 gas is behaving ideally). The pressure inside the flask in bar is (Given R = 0.0831 L bar K^{-1} mol^{-1})
(1) 498.6 (2) 49.8
(3) 4.9 (4) 2.5

15. Four gas cylinders containing He, N_2, CO_2 and NH_3 gases separately are gradually cooled from a temperature of 500 K. Which gas will liquify first ?
(Given T_C in K – He : 5.3, N_2 : 126, CO_2 : 304.1 and NH_3 : 405.5)
(1) He (2) N_2 (3) CO_2 (4) NH_3

16. A vessel contains 3.2 g of dioxygen gas at STP (273.15 K and 1 atm pressure). The gas is now transferred to another vessel at constant temperature, where pressure becomes one third of the original pressure. The volume of new vessel in L is :
(Given - molar volume at STP is 22.4 L)
(1) 6.72 (2) 2.24 (3) 22.4 (4) 67.2

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	1	4	1	1	4	3	4	3	4	1	4	3	3	4
Question	16														
Answer	1														

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Exercise – III (Analytical Questions) Master Your Understanding

1. Out of following statement :
(A) Gases are highly compressible
(B) Gases exert pressure equally in all direction
(C) Only at constant temperature $P \propto \frac{1}{V}$
(D) Gases have much lower density than solids and liquids
The correct statement is/are :
(1) A, B are correct
(2) A, B and D are correct
(3) B, C and D are correct
(4) A, B, C and D are correct

2. From the following data :

(a)	Standard temperature and pressure (STP)	(p)	273.15 K and 1 bar
(b)	Standard ambient temperature and pressure (SATP)	(q)	298.15 K and 1 bar
(c)	Molar volume of gas at STP	(r)	22.413 L
(d)	Molar volume of gas at SATP	(s)	24.789 L

The correct match is :
(1) a-p, b-q, c-s, d-r (2) a-p, b-q, c-r, d-s
(3) a-r, b-p, c-q, d-s (4) a-s, b-p, c-q, d-r

3. Which of the following is incorrect ?
(1) $P_{total} = P_1 + P_2 + P_3 + ...$ (at constant T and V)
(2) $P_{dry} = P_{total} - P_{aqueous\ tension}$
(3) $Pi = x_i \times P_{total}$
(4) $Pi = \frac{n_{total}RT}{V_{total}}$

4. From the given set of statement/data :
(A) Normal boiling point means boiling point at 1 atm pressure
(B) Standard boiling point means boiling point at 1 bar pressure
(C) At STP (0°C and 1 bar pressure) molar volume is 22.4 L of an ideal gas
(D) At SATP (25°C and 1 bar pressure) molar volume is 22.4 L of an ideal gas
The correct statement is :
(1) A only (2) D only
(3) B, C and D only (4) A, B and C only

5. Given below are two statements:
Statement-I : Gases are generally collected over water and therefore are moist.
Statement-II : Pressure exerted by saturated water vapour is called aqueous tension.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both statement-I and statement-II are incorrect
(2) Both statement-I and statement-II are correct
(3) Statement-I is incorrect and statement-II is correct
(4) Statement-I is correct and statement-II is incorrect

6. Given below are two statements:
Statement-I : Boyle's temperature of gas depends upon its nature.
Statement-II : Above Boyle's temperature real gases shows negative deviation from ideality.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both statement-I and statement-II are incorrect
(2) Both statement-I and statement-II are correct
(3) Statement-I is incorrect and statement-II is correct
(4) Statement-I is correct and statement-II is incorrect

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7. Match the following gas laws with equation representing:

(p)	Boyle's law	(a)	$V \propto n$; at constant T & P
(q)	Charle's law	(b)	$P_{total} = P_1 + P_2 + P_3 + \ldots$ at constant T & V
(r)	Dalton's law	(c)	$\frac{PV}{nT}$ = constant
(s)	Avogadro's law	(d)	$V \propto T$; (at constant n and P)
(t)	Ideal gas law	(e)	$V \propto \frac{1}{P}$ (at constant n and T)

The correct match is :
(1) (p - e), (q - d), (r - b), (s - a), (t - c)
(2) (p - d), (q - e), (r - a), (s - b), (t - c)
(3) (p - d), (q - e), (r - b), (s - a), (t - c)
(4) (p - b), (q - d), (r - c), (s - a), (t - c)

8. Given below are two statements; one is labelled as **Assertion (A)** and the other is labelled as **Reason(R)** .
Assertion (A) : Gases do not liquify above their critical temperature even on applying high pressure.
Reason (R) : Above critical temperature molecular speed become high and inter molecular attractions can not hold molecules together.
In the light of the above statements, choose the **most appropriate** answer from the options given below :
(1) Both A and R are true and R is the correct explanation of A
(2) Both A and R are true but R is not correct explanation of A
(3) A is true but R is false
(4) A is false but R is true

9. Given below are two statements; one is labelled as **Assertion (A)** and the other is labelled as **Reason(R)** .
Assertion (A) : Gases having higher critical temperature can be liquefied easily.
Reason (R) : Because attractive forces are higher for gases having higher critical temperature
In the light of the above statements, choose the **most appropriate** answer from the options given below :
(1) Both A and R are true and R is the correct explanation of A
(2) Both A and R are true but R is not correct explanation of A
(3) A is true but R is false
(4) A is false but R is true

10. Given below are two statements:
Statement-I : Hydrogen bonding and vander waals forces are strong enough to cause high viscosity.
Statement-II : Glass is an extremely viscous liquid.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both statement-I and statement-II are incorrect
(2) Both statement-I and statement-II are correct
(3) Statement-I is incorrect and statement-II is correct
(4) Statement-I is correct and statement-II is incorrect

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10
Answer	2	2	4	4	2	4	1	1	1	2

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